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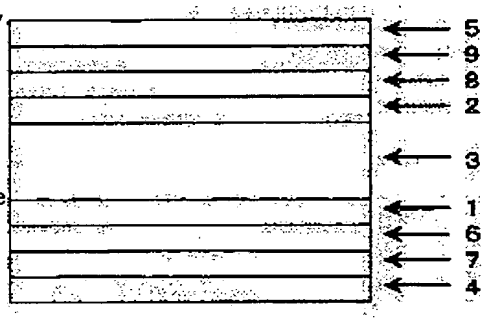
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To realize semitransparent liquid crystal display device in which optical characteristic such as contrast is satisfactory and viewing angle is wide in the semitransparent liquid crystal display device.

SOLUTION: In this liquid crystal device, wherein a liquid crystal layer is inserted between one substrate containing both reflection parts and transmission parts and the other substrate on which opposite electrodes are formed, a first polarizing plate is provided on the surface of the one substrate and a second polarizing plate is provided on the surface of the other substrate respectively, a first 1/4 wavelength plate and a second 1/2 wavelength plate are provided between the first polarizing plate and the one substrate, and a third 1/4 wavelength plate and a fourth 1/2 wavelength plate are provided between the second polarizing plate and the other substrate, a liquid crystal film obtained by performing hybrid orientation of nematic liquid crystal is used as the first 1/4 wavelength plate.



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CLAIMS

[Claim(s)]
[Claim 1] On the other hand, a liquid crystal layer is pinched between the substrates and the another side electrodes with which the counterelectrode was formed possessing both the reflective section and the transparency section. It has the 2nd polarizing plate in the field of the aforementioned one side substrate in the field of the 1st polarizing plate and said another side substrate, respectively. In the liquid crystal display which, on the other hand, has the 1st quadrant wavelength plate and the 2nd 1/2 wavelength plate between substrates with said 1st polarizing plate, and has the 3rd quadrant wavelength plate and the 4th 1/2 wavelength plate between said 2nd polarizing plate and another side substrates The liquid crystal display characterized by said 1st quadrant wavelength plate being a liquid crystal film.
[Claim 2] The liquid crystal display according to claim 1 characterized by said liquid crystal film being a liquid crystal film to which it comes to carry out hybrid orientation of the nematic liquid crystal.
[Claim 3] The liquid crystal display according to claim 1 with which the direction of the hybrid orientation of the nematic liquid crystal which forms said liquid crystal film, and the direction of n director of said liquid crystal layer are characterized by being arranged at the reverse sense.
[Claim 4] The liquid crystal display according to claim 1 characterized by the include angle of the optical axis of said liquid crystal film and n director of said liquid crystal layer to make being less than 5 times.
[Claim 5] The liquid crystal display according to claim 1 characterized by setting up the include angle of the shaft expressed with the include angle of ((a+b)/2), and the absorption shaft of said 1st polarizing plate to make between 30 degrees and 60 degrees when the include angle of the optical axis of said liquid crystal film is set to a and the include angle of the optical axis of said 2nd 1/2 wavelength plate is set to b.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]

[Field of the Invention] A liquid crystal film is used for this invention as a quadrant wavelength plate, and it relates to the transflective LCD to which the angle of visibility at the time of a transparency display was expanded.

[0002]

[Description of the Prior Art] the liquid crystal display component by which the current activity is carried out was divided roughly, and the array direction of a nematic liquid crystal molecule was twisted at 90 degrees on the front face of the electrode substrate which makes a couple by two upper and lower sides -- twist nematic (It is hereafter called TN) The thing using the mode, the thing using the super twist nematic (henceforth STN) mode which twisted the array direction of a nematic molecule at 300 degrees from 180 degrees between vertical electrode substrates, the thing using a ferroelectric liquid crystal, etc. exist.

[0003] Moreover, each calls the liquid crystal display currently used for the word processor, the personal computer, the monitor, etc. a transparency mold liquid crystal display using a back light. The liquid crystal display whose display is enabled only by outdoor daylight using a reflecting plate is said to the tooth back of a liquid crystal display as a reflective mold liquid crystal display to it, without using a back light, and it is used for the calculator etc. Moreover, by progress of the information communication technology of these days, pocket communication terminals, such as a cellular phone and PDA, spread, and the liquid crystal commercial scene was expanded greatly. Since these pocket communication terminals serve as a property with an important low power, it is usually that a reflective mold liquid crystal display is used. However, the brightness of a reflective mold liquid crystal display is low, and its transflective type liquid crystal display which both the reflective section and the transparency section are provided, and at least ** is [liquid crystal display] a reflective mold and can display it in a transparency mold in a dark environment in a bright environment in a pixel since a display is hard to be recognized in an environment is in use.

[0004] With these spread, the user want to image quality also becomes still severer, and is strongly demanded especially about amplification of an angle of visibility.

[0005]

[Problem(s) to be Solved by the Invention] Especially in the conventional transflective LCD, the technical problem that the angle-of-visibility property at the time of a transparency display became narrow also with four directions occurred.

[0006] This invention was made in view of such an above-mentioned trouble, its contrast is higher than before, and four directions aim at realizing a transflective LCD with a large angle of visibility.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention according to claim 1 On the other hand, a liquid crystal layer is pinched between the substrates and the another side electrodes with which the counterelectrode was formed possessing both the reflective section and the transparency section. It has the 2nd polarizing plate in the field of the aforementioned one side substrate in the field of the 1st polarizing plate and said another side substrate, respectively. In the liquid crystal display which, on the other hand, has the 1st quadrant wavelength plate and the 2nd 1/2 wavelength plate between substrates with said 1st polarizing plate, and has the 3rd quadrant wavelength plate and the 4th 1/2 wavelength plate between said 2nd polarizing plate and another side substrates It is related with the liquid crystal display characterized by said 1st quadrant wavelength plate being a liquid crystal film.

[0008] Invention according to claim 2 relates to the liquid crystal display characterized by said liquid crystal film being a liquid crystal film to which it comes to carry out hybrid orientation of the nematic liquid crystal in a liquid crystal display according to claim 1.

[0009] Invention according to claim 3 is characterized by arranging the direction of the hybrid orientation of the nematic liquid crystal which forms said liquid crystal film, and the direction of n director of said liquid crystal layer at the reverse sense in a liquid crystal display according to claim 1.

[0010] Invention according to claim 4 is characterized by the include angle of the optical axis of said liquid crystal film and n director of said liquid crystal layer to make being less than 5 times in a liquid crystal display according to claim 1.

[0011] In a liquid crystal display according to claim 1, invention according to claim 5 is characterized by setting up the include angle of the shaft expressed with the include angle of ((a+b)/2), and the absorption shaft of said 1st polarizing plate to make between 30 degrees and 60 degrees, when the include angle of the optical axis of said liquid crystal film is set to a and the include angle of the optical axis of said 2nd 1/2 wavelength plate is set to b.

[0012]

[Embodiment of the Invention] (Gestalt of operation) The liquid crystal display in the gestalt of operation of this invention is explained using a drawing. Drawing 1 is the sectional view showing the outline configuration of the liquid crystal display of the gestalt of this operation. On the other hand, this liquid crystal display 1 pinches the liquid crystal layer 3 between the substrates 1 and the another side substrates 2 with which the counterelectrode was formed possessing both the reflective section and the transparency section. On the other hand, it has the 2nd polarizing plate 5 for the 1st polarizing plate 4 in the field of an another side substrate in the field of a substrate 1, respectively. It consists of a configuration that, on the other hand, have the 1st quadrant wavelength plate 6 and the 2nd 1/2 wavelength plate 7 between substrates 1 with the 1st polarizing plate 4, and the 3rd quadrant wavelength plate 8 and the 4th 1/2 wavelength plate 9 have been arranged between the 2nd polarizing plate 5 and the another side substrate 2. At this time, high polymer films, such as a polycarbonate which is the same construction material as the 3rd quadrant wavelength plate 8 or the 2nd and 4th 1/2 wavelength plate 7 and 9 as 1st quadrant wavelength plate, were used in the conventional example. On the other hand, in the liquid crystal display of this application, the liquid crystal film to which hybrid orientation of the nematic liquid crystal was carried out as 1st quadrant wavelength plate 6 is used. The reason is explained below.

[0013] Drawing 2 is property drawing having shown the angle-of-visibility property at the time of the transparency display of the liquid crystal display of this invention, and the conventional liquid crystal display. The angle-of-visibility [can set drawing 2 (a) to the liquid crystal display of this invention, and / drawing 2 / (b)] property at the time of the transparency display of the conventional liquid crystal display is shown, respectively. As shown in drawing 2 , the angle-of-visibility property at the time of the transparency display in the liquid crystal display of this invention is clear in having expanded four directions dramatically as compared with the conventional liquid crystal display. Why the angle-of-visibility property of the liquid crystal display of this invention is improved was shown below.

[0014] Drawing 3 is the mimetic diagram having shown the structure of the liquid crystal film (NH film, the Nippon Oil Mitsubishi make) 6 used for the liquid crystal display of this invention. It is having structure to which hybrid orientation of the nematic liquid crystal 11 was carried out on the base material 10, and the arrow head 12 in drawing shows the direction of hybrid orientation. On the other hand, on a substrate 1, drawing 4 is one block diagram having shown the relation between the liquid crystal molecule of the liquid crystal layer 3, and the liquid crystal film 6 which is carrying out orientation, and shows an example of the gestalt of operation. The arrow head 13 shows the direction of n director of a liquid crystal layer. When an electrical potential difference is impressed to the liquid crystal layer 3, the liquid crystal molecule which is carrying out orientation on the substrate 1 on the other hand is in the condition near hybrid orientation near the substrate interface, in order that it may not change for the achoring energy received from a substrate, but it may separate from a substrate interface and a liquid crystal molecule with little effect of achoring energy may answer an electrical potential difference. In the liquid crystal display of the conventional example, an angle-of-visibility property benefits narrow the birefringence of the liquid crystal molecule near [this] the interface. Since the liquid crystal display of this invention can cancel the birefringence of the liquid crystal molecule near the interface by arranging the direction 13 of n director of the liquid crystal molecule of the liquid

crystal layer 3, and the direction 12 of the hybrid orientation of the liquid crystal film 6 to the reverse sense, it becomes possible to improve an angle-of-visibility property greatly. Moreover, since this liquid crystal film 6 also possesses simultaneously the phase contrast plate function in which the phase contrast of birefringence light is quadrant wavelength, thin shape-ization of it is also attained.

[0015] Drawing 5 is the mimetic diagram having shown the relation of each arrangement of the direction of n director of the absorption shaft of the 1st polarizing plate 4, the optical axis of the liquid crystal film 6 which is the 1st quadrant wavelength plate, the optical axis of the 2nd 1/2 wavelength plate 7, and the liquid crystal layer 3. The include angle of the Shaft A and the absorption shaft of the 1st polarizing plate 4 by which the include angle of the optical axis of the liquid crystal film 6 whose a is the 1st quadrant wavelength plate, and b are expressed with the include angle of the optical axis of the 2nd 1/2 wavelength plate 7 among drawing 5 , and c is expressed with the include angle of ((a+b)/2) to make, and d are carrying out the table of the include angle of the optical axis of the liquid crystal film 6, and n director of the liquid crystal layer 3 to make, respectively. Although especially definition is not carried out about these include angles, as for d, arranging within 5 times is desirable, and c is desirable when arranging in the range of 30 to 60 degrees takes into consideration the balance of optical properties, such as contrast, and an angle-of-visibility property.

[0016] Thus, it is possible to offer the transflective LCD which contrast was good, and the angle of visibility was large, and fitted all environments by this invention.

[0017]

[Effect of the Invention] According to this invention, on the other hand, a liquid crystal layer is pinched as mentioned above between the substrates and the another side electrodes with which the counterelectrode was formed possessing both the reflective section and the transparency section. It has the 2nd polarizing plate in the field of the aforementioned one side substrate in the field of the 1st polarizing plate and said another side substrate, respectively. In the liquid crystal display which, on the other hand, has the 1st quadrant wavelength plate and the 2nd 1/2 wavelength plate between substrates with said 1st polarizing plate, and has the 3rd quadrant wavelength plate and the 4th 1/2 wavelength plate between said 2nd polarizing plate and another side substrates By using the liquid crystal film to which hybrid orientation of the nematic liquid crystal was carried out as said 1st quadrant wavelength plate it becomes possible to compensate optically the birefringence of the liquid crystal molecule near the substrate interface, it becomes possible to realize simultaneously amplification of the optical property and angle of visibility which were [contrast] excellent, and it becomes possible to offer the liquid crystal display whose display property was markedly alike and improved as compared with the conventional liquid crystal display.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the outline configuration of the liquid crystal display in the gestalt of operation of this invention

[Drawing 2] (a) Property drawing having shown the angle-of-visibility property of the liquid crystal display of this invention

(b) Property drawing having shown the angle-of-visibility property of the conventional liquid crystal display

[Drawing 3] The sectional view showing the outline configuration of the liquid crystal film used for the liquid crystal display of this invention

[Drawing 4] One block diagram having shown the relation between the liquid crystal molecule on the substrate of the liquid crystal display of this invention, and a liquid crystal film

[Drawing 5] The mimetic diagram having shown the relation of each arrangement of the direction of n director of the absorption shaft of the 1st polarizing plate 4 in the liquid crystal display of this invention, the optical axis of the liquid crystal film 6 which is the 1st quadrant wavelength plate, the optical axis of the 2nd 1/2 wavelength plate 7, and the liquid crystal layer 3

[Description of Notations]

1 It is Substrate while Both Reflective Section and Transparency Section were Provided.

2 Another Side Substrate with which Counterelectrode was Formed

3 Liquid Crystal Layer

4 1st Polarizing Plate Arranged on the Other Hand in Field of Substrate

5 2nd Polarizing Plate Arranged in Field of Another Side Substrate

6 1st Quadrant Wavelength Plate

7 2nd 1/2 Wavelength Plate

8 3rd Quadrant Wavelength Plate

9 4th 1/2 Wavelength Plate

10 Base Material

11 Nematic Liquid Crystal in Liquid Crystal Film 6

12 The Direction of Hybrid Orientation of Liquid Crystal Film 6

13 The Direction of N Director of Liquid Crystal Molecule of Liquid Crystal Layer 3

The include angle of the optical axis of the liquid crystal film 6 which is the 1st quadrant wavelength plate

b The include angle of the optical axis of the 2nd 1/2 wavelength plate 7

A (a+b) The shaft expressed with the include angle of /2

c The include angle of Shaft A and the absorption shaft of the 1st polarizing plate 4 to make

d The include angle of the optical axis of the liquid crystal film 6, and n director of the liquid crystal layer 3 to make

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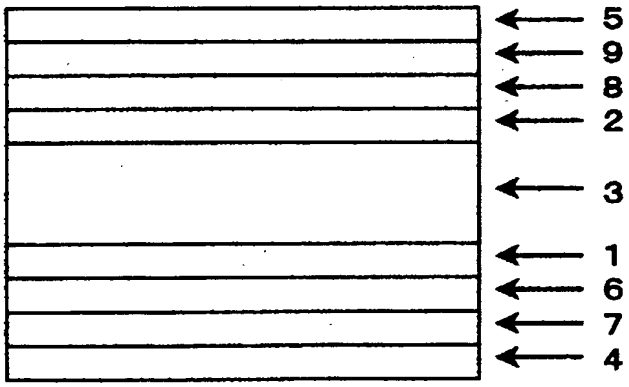
最終頁に続く

(54)【発明の名称】　液晶表示装置

(57)【要約】
【課題】　半透過型液晶表示装置において、コントラストなどの光学特性が良好で、かつ、視野角が広い半透過型液晶表示装置を実現する。
【解決手段】　反射部と透過部の両方を具備した一方基板と対向電極が形成された他方電極との間に液晶層を挟持し、前記一方基板の面に第1の偏光板、前記他方基板の面に第２の偏光板をそれぞれ有し、前記第１の偏光板と一方基板の間に第１の４分の１波長板と第２の２分の１波長板を有し、前記第２の偏光板と他方基板の間に第３の４分の１波長板と第４の２分の１波長板を有する液晶表示装置において、前記第１の４分の１波長板としてネマチック液晶をハイブリッド配向させた液晶フィルムを使用する。



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【特許請求の範囲】

【請求項１】　反射部と透過部の両方を具備した一方基板と対向電極が形成された他方電極との間に液晶層を挟持し、前記一方基板の面に第1の偏光板、前記他方基板の面に第２の偏光板をそれぞれ有し、前記第１の偏光板と一方基板の間に第１の４分の１波長板と第２の２分の１波長板とを有し、前記第２の偏光板と他方基板の間に第３の４分の１波長板と第４の２分の１波長板とを有する液晶表示装置において、前記第１の４分の１波長板が液晶フィルムであることを特徴とする液晶表示装置。

【請求項２】　前記液晶フィルムが、ネマチック液晶をハイブリッド配向させてなる液晶フィルムであることを特徴とする請求項１記載の液晶表示装置。

【請求項３】　前記液晶フィルムを形成するネマチック液晶のハイブリッド配向の方向と前記液晶層のｎダイレクター方向が、逆向きに配置されていることを特徴とする請求項１記載の液晶表示装置。

【請求項４】　前記液晶フィルムの光軸と前記液晶層のｎダイレクターとのなす角度が５度以内であることを特徴とする請求項１記載の液晶表示装置。

【請求項５】　前記液晶フィルムの光軸の角度をａとし、前記第２の２分の１波長板の光軸の角度をｂとしたとき、（（ａ＋ｂ）／２）の角度で表される軸と、前記第１の偏光板の吸収軸とのなす角度が３０度から６０度の間に設定されることを特徴とする請求項１記載の液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、４分の１波長板として液晶フィルムを用い、透過表示時における視野角を拡大した半透過型液晶表示装置に関する。

【０００２】

【従来の技術】現在使用されている液晶表示素子は大別して、上下２枚で一対をなす電極基板の表面でネマチック液晶分子の配列方向を９０度にねじったツイスト・ネマチック（以下、ＴＮという）モードを利用したもの、上下電極基板の間でネマチック分子の配列方向を１８０度から３００度にねじったスーパーツイスト・ネマチック（以下、ＳＴＮという）モードを利用したもの、また、強誘電性液晶を用いたものなどが存在する。

【０００３】また、ワードプロセッサ、パーソナルコンピュータやモニター等に使用されている液晶表示装置は、いずれもバックライトを使用したものであり透過型液晶表示装置という。それに対し、バックライトを使用せずに液晶表示装置の背面に反射板を使用して外光だけで表示可能にする液晶表示装置を反射型液晶表示装置といい、電卓などに使用されている。また、昨今の情報通信技術の進展により、携帯電話やＰＤＡなどの携帯通信端末が普及し、液晶市場を大きく拡大した。これらの携帯通信端末は、低消費電力が重要な特性となるため反射

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型液晶表示装置が使用されるのが通例である。しかしながら、反射型液晶表示装置の輝度は低く、薄くらい環境では表示が認識されにくいため、画素内に反射部と透過部の両方を具備し、明るい環境では反射型で、暗い環境では透過型で表示させることができる半透過型の液晶表示装置が主流となっている。

【０００４】これらの普及に伴い、画質に対するユーザー要望も益々厳しくなり、特に視野角の拡大について強く要望されている。

【０００５】

【発明が解決しようとする課題】従来の半透過型液晶表示装置では、特に透過表示時の視野角特性が上下左右とも狭くなるという課題があった。

【０００６】本発明は、このような上記の問題点に鑑みてなされたもので、従来よりも、コントラストが高く、上下左右ともに視野角が広い半透過型液晶表示装置を実現することを目的とする。

【０００７】

【課題を解決するための手段】上記の課題を解決するため、請求項1記載の発明は、反射部と透過部の両方を具備した一方基板と対向電極が形成された他方電極との間に液晶層を挟持し、前記一方基板の面に第1の偏光板、前記他方基板の面に第２の偏光板をそれぞれ有し、前記第１の偏光板と一方基板の間に第１の４分の１波長板と第２の２分の１波長板を有し、前記第２の偏光板と他方基板の間に第３の４分の１波長板と第４の２分の１波長板を有する液晶表示装置において、前記第１の４分の１波長板が液晶フィルムであることを特徴とする液晶表示装置に関する。

【０００８】請求項２記載の発明は、請求項１記載の液晶表示装置において、前記液晶フィルムが、ネマチック液晶をハイブリッド配向させてなる液晶フィルムであることを特徴とする液晶表示装置に関する。

【０００９】請求項３記載の発明は、請求項１記載の液晶表示装置において、前記液晶フィルムを形成するネマチック液晶のハイブリッド配向の方向と前記液晶層のｎダイレクター方向が、逆向きに配置されていることを特徴とする。

【００１０】請求項４記載の発明は、請求項１記載の液晶表示装置において、前記液晶フィルムの光軸と前記液晶層のｎダイレクターとのなす角度が５度以内であることを特徴とする。

【００１１】請求項５記載の発明は、請求項１記載の液晶表示装置において、前記液晶フィルムの光軸の角度をａとし、前記第２の２分の１波長板の光軸の角度をｂとしたとき、（（ａ＋ｂ）／２）の角度で表される軸と、前記第１の偏光板の吸収軸とのなす角度が３０度から６０度の間に設定されることを特徴とする。

【００１２】

【発明の実施の形態】（実施の形態）本発明の実施の形

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態における液晶表示装置について、図面を用いて説明する。図１は本実施の形態の液晶表示装置の概略構成を示す断面図である。この液晶表示装置１は、反射部と透過部の両方を具備する一方基板１と対向電極が形成された他方基板２との間に液晶層３を挟持し、一方基板１の面に第１の偏光板４を、他方基板の面には第２の偏光板５をそれぞれ有し、第１の偏光板４と一方基板１の間には第１の４分の１波長板６と第２の２分の１波長板７を有し、また、第２の偏光板５と他方基板２の間には第３の４分の１波長板８と第４の２分の１波長板９が配置された構成からなる。このとき、従来例では第１の４分の１波長板として、第３の４分の１波長板８や第２、第４の２分の１波長板７、９と同じ材質であるポリカーボネートなどの高分子フィルムが使用されていた。これに対して、本願の液晶表示装置では、第１の４分の１波長板６としてネマチック液晶をハイブリッド配向させた液晶フィルムを使用する。その理由を以下に説明する。

【００１３】図２は、本発明の液晶表示装置と従来の液晶表示装置の透過表示時における視野角特性を示した特性図である。図２（ａ）は本発明の液晶表示装置、図２（ｂ）は従来の液晶表示装置の透過表示時における視野角特性をそれぞれ示す。図２に示したように、本発明の液晶表示装置における透過表示時の視野角特性は、従来の液晶表示装置と比較し、上下左右ともに劇的に拡大していることが明確である。本発明の液晶表示装置の視野角特性が改善される理由を以下に示した。

【００１４】図３は、本発明の液晶表示装置に使用した液晶フィルム（ＮＨフィルム、日石三菱（株）製）６の構造を示した模式図である。支持体１０の上にネマチック液晶１１をハイブリッド配向させた構造をしており、図中の矢印１２は、ハイブリッド配向の方向を示している。図４は、一方基板１上に配向している液晶層３の液晶分子と液晶フィルム６の関係を示した一構成図であり、実施の形態の一例を示す。矢印１３は液晶層のｎダイレクターの方向を示している。液晶層３に電圧が印加されたとき、一方基板１上に配向している液晶分子は基板から受けるアンカリングエネルギーのため変化せず、基板界面から離れ、アンカリングエネルギーの影響が少ない液晶分子が電圧に応答するため、基板界面の近傍ではハイブリッド配向に近い状態となっている。従来例の液晶表示装置では、この界面近傍の液晶分子の複屈折性のために視野角特性が狭くなる。本発明の液晶表示装置は、液晶層３の液晶分子のｎダイレクター方向１３と液晶フィルム６のハイブリッド配向の方向１２を逆向きに配置することにより、界面近傍の液晶分子の複屈折性をキャンセルできるため、視野角特性を大きく改善することが可能になる。また、この液晶フィルム６は複屈折光の位相差が４分の１波長である位相差板機能も同時に具備しているため、薄型化も可能となる。

【００１５】図５は、第１の偏光板４の吸収軸、第１の

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４分の１波長板である液晶フィルム６の光軸、第２の２分の１波長板７の光軸、液晶層３のｎダイレクター方向のそれぞれの配置の関係を示した模式図である。図５中、ａは第１の４分の１波長板である液晶フィルム６の光軸の角度、ｂは第２の２分の１波長板７の光軸の角度、ｃは（（ａ＋ｂ）／２）の角度で表される軸Ａと第１の偏光板４の吸収軸とのなす角度、ｄは液晶フィルム６の光軸と液晶層３のｎダイレクターとのなす角度をそれぞれ表している。これらの角度については特に限定はされないが、ｄは５度以内に配置することが好ましく、また、ｃは３０度から６０度の範囲に配置することがコントラストなどの光学特性と視野角特性とのバランスを考慮すると好ましい。

【００１６】このように本発明により、コントラストが良好で視野角が広く、あらゆる環境に適した半透過型液晶表示装置を提供することが可能である。

【００１７】

【発明の効果】以上のように本発明によれば、反射部と透過部の両方を具備した一方基板と対向電極が形成された他方電極との間に液晶層を挟持し、前記一方基板の面に第1の偏光板、前記他方基板の面に第２の偏光板をそれぞれ有し、前記第１の偏光板と一方基板の間に第１の４分の１波長板と第２の２分の１波長板を有し、前記第２の偏光板と他方基板の間に第３の４分の１波長板と第４の２分の１波長板を有する液晶表示装置において、前記第１の４分の１波長板としてネマチック液晶をハイブリッド配向させた液晶フィルムを使用することにより、基板界面近傍の液晶分子の複屈折性を光学的に補償することが可能となり、コントラストなどの優れた光学特性と視野角の拡大を同時に実現することが可能となり、従来の液晶表示装置と比較し、格段に表示特性が向上した液晶表示装置を提供することが可能となる。

【図面の簡単な説明】

【図１】本発明の実施の形態における液晶表示装置の概略構成を示す断面図

【図２】（ａ）本発明の液晶表示装置の視野角特性を示した特性図

（ｂ）従来の液晶表示装置の視野角特性を示した特性図

【図３】本発明の液晶表示装置に使用した液晶フィルムの概略構成を示す断面図

【図４】本発明の液晶表示装置の基板上の液晶分子と液晶フィルムの関係を示した一構成図

【図５】本発明の液晶表示装置における、第１の偏光板４の吸収軸、第１の４分の１波長板である液晶フィルム６の光軸、第２の２分の１波長板７の光軸、液晶層３のｎダイレクター方向のそれぞれの配置の関係を示した模式図

【符号の説明】

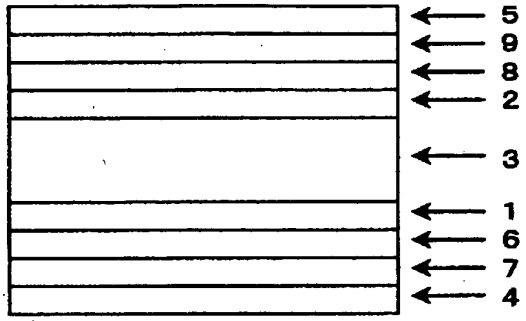
１　反射部と透過部の両方を具備した一方基板

２　対向電極が形成された他方基板

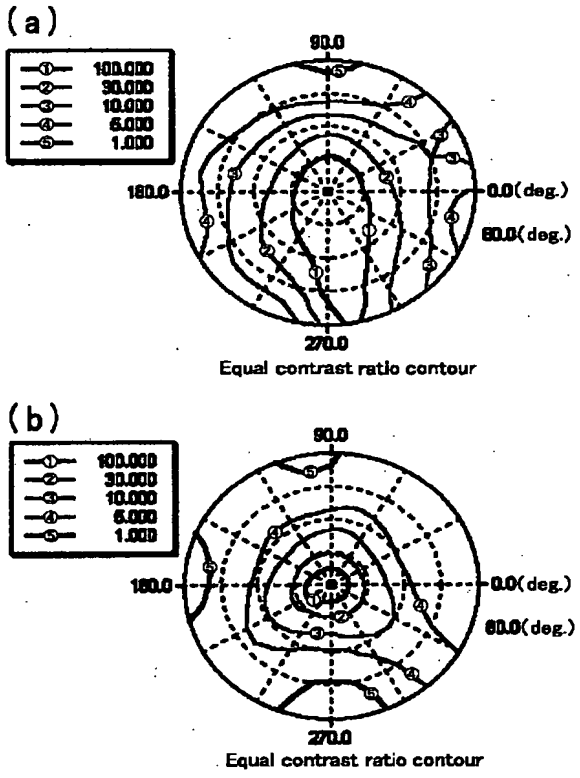
3　液晶層
4　一方基板の面に配置された第１の偏光板
5　他方基板の面に配置された第２の偏光板
6　第１の４分の１波長板
7　第２の２分の１波長板
8　第３の４分の１波長板
9　第４の２分の１波長板
１０　支持体
１１　液晶フィルム６中のネマチック液晶

１２　液晶フィルム６のハイブリッド配向の方向
１３　液晶層３の液晶分子のｎダイレクター方向
ａ　第１の４分の１波長板である液晶フィルム６の光軸の角度
ｂ　第２の２分の１波長板７の光軸の角度
Ａ　（（ａ＋ｂ）／２）の角度で表される軸
ｃ　軸Ａと第１の偏光板４の吸収軸とのなす角度
ｄ　液晶フィルム６の光軸と液晶層３のｎダイレクターとのなす角度

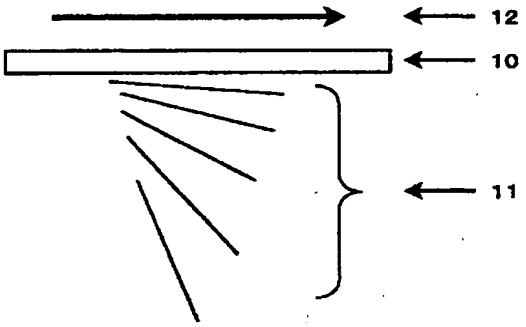
【図１】



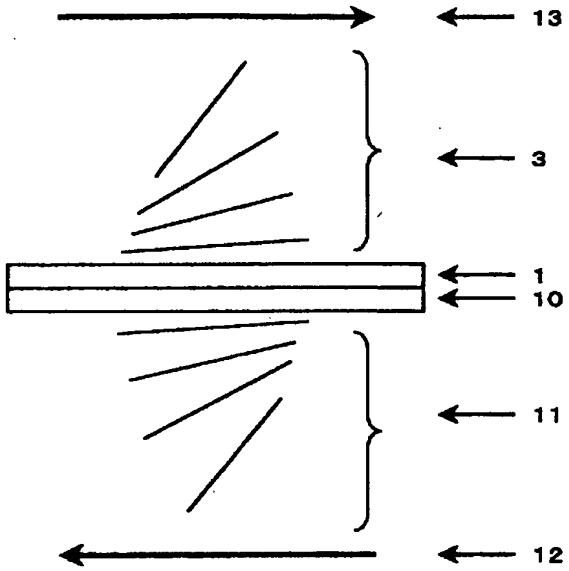
【図２】



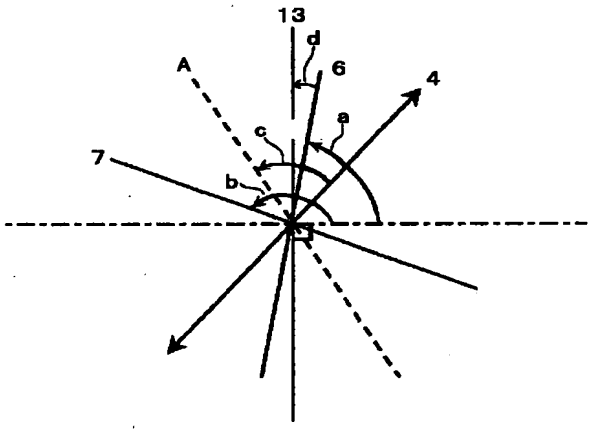
【図３】



【図４】



【図５】



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